

AIRS/AMSU/HSB Version 4.0 Data Disclaimer

Edited by:
Edward T. Olsen

Contributions by:
Hartmut Aumann, Steve Broberg, Luke Chen, Denis Elliott,
Eric Fetzer, Evan Fishbein, Steve Friedman, Steve Gaiser,
Stephanie Granger, Manju Kapoor, Bjorn Lambrigtsen,
Sung-Yung Lee, Steve Licata, Evan Manning
Jet Propulsion Laboratory, California Institute of Technology
and
John Blaisdell, Joel Susskind
Goddard Space Flight Center, NASA



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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Submit Questions to:

http://airs-inquiry.jpl.nasa.gov/feedback/feedback_form.cfm

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AIRS/AMSU/HSB Data Disclaimer

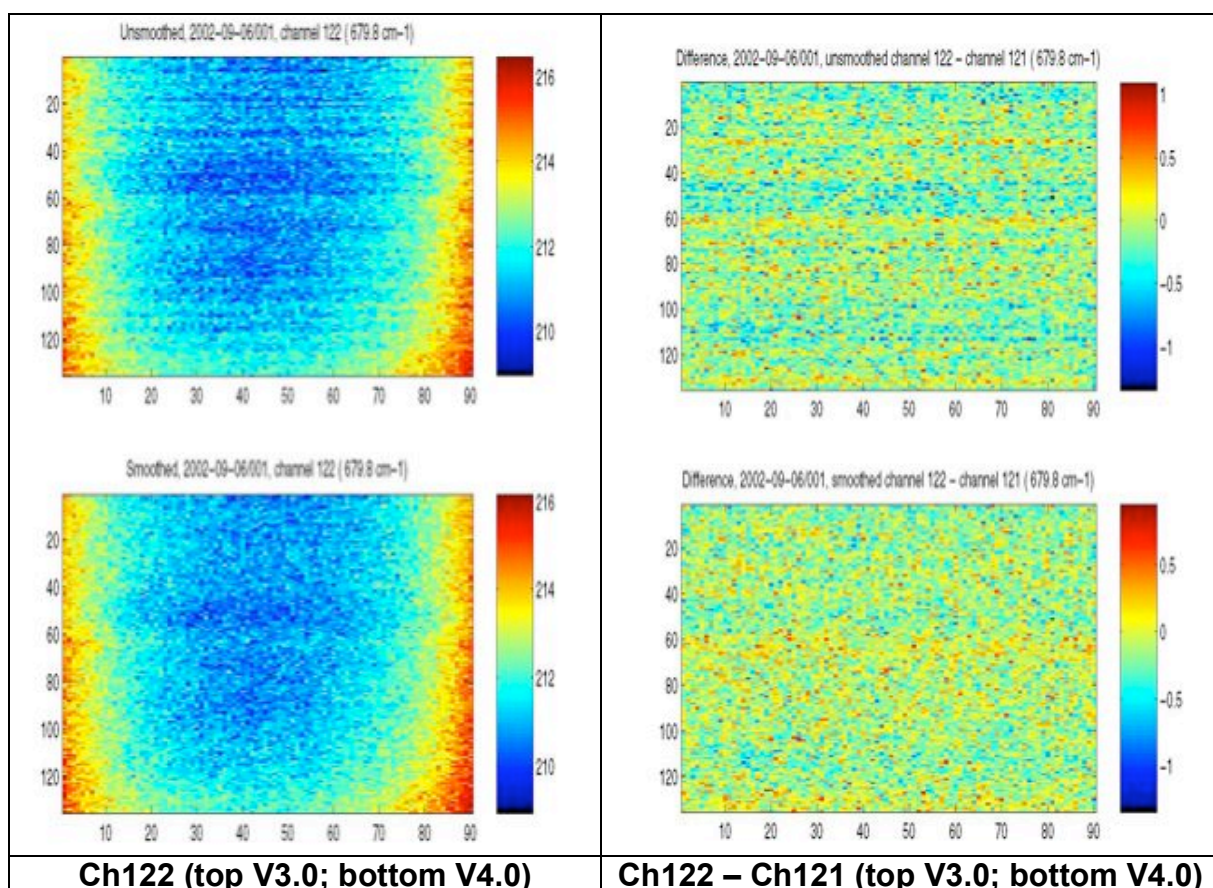
Please read this before reporting problems with data or data availability. The following factors may have affected the data products you have ordered.

Submit questions to: http://airs-inquiry.jpl.nasa.gov/feedback/feedback_form.cfm

Differences between Version 3.0 and Version 4.0

The basic retrieval methodology has not changed between V3.0 and V4.0, but many details have changed as we have had acquired more experience with the data. These changes, from Level 1 processing onward, mean that all output parameters will be slightly different in V4.0 when compared to previous versions.

The calibration algorithm which converts AIRS L1B radiances from raw counts has been modified slightly to implement “offset smoothing” to reduce “striping”, or artificial correlations within a scanline. The V3.0 algorithm calculated the offset for each channel once per scan as the median of 8 space views. The residual noise in the offset in some channels was large enough to be visible. The new algorithm calculates the offset using a linear fit in time across 10 scan lines. As a result scan line angle-dependent biases are corrected by up to 10 mK in some channels and noise estimates are slightly improved. The figure below shows the impact of offset smoothing.



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A report on the status of V4.0 calibration is provided in the document:

V4.0_Calibration_Status.pdf

The most important difference to a user between V3.0 and V4.0 is the introduction of product-specific quality flags. The casual user can continue to rely on requiring **RetQAFlag** to be zero as a quick way to filter out all but the best retrievals, but this all-or-nothing approach will reduce yield and excise the good data in the retrieval FOV along with the questionable data. The user will find it profitable to rely instead on the new **Qual_*** flags for temperature, water, ozone, and clouds. Please read the Level 2 Quality Flags Quick Start documentation for a description of these flags.

V4.0_L2_QualFlag_QuickStart.pdf

The quantities on which the new quality flags are based are written out in the Level 2 Support Product. We do not encourage second-guessing of the threshold values that were used to set the quality flags in the Level 2 Standard Product, but users may find these values useful if they desire to further refine their filtering of retrieved products in specific parts of the atmosphere.

Another product in which the user will notice a significant difference is the clouds. In V3.0 the retrieved clouds were over-constrained to a somewhat arbitrary first guess. For V4.0 the guess was improved and the constraints were loosened which results in more realistic cloud parameters. The user must be aware that the cloud parameters solved for are the tops of two flat black clouds at different levels, with different fractions (but not cloud top pressures) among the nine AIRS spots which are contained within the AMSU footprint (and retrieval FOV). In many cases this small number of output parameters is not very realistic but the retrieval algorithm finds a best radiative fit to this output format. Please be aware that the cloud clearing algorithm is not constrained to this type of cloud; cloud clearing by its nature works with cloud formations, which can have any fixed vertical structure while varying in cloud amount. Up to four cloud formations are allowed.

The surface emissivity over ocean follows the shape of Wu and Smith ("Emissivity of rough sea surface for 8-13um: modeling and verification," Appl. Opt. 36, 2609-2619 (1997)) as recomputed at higher spectral resolution by van Delst and Wu (<http://airs2.ssec.wisc.edu/~paulv/#IRsse>), with one overall adjustment parameter for wind speed of 5 meters/sec. Over land (and ice) the first guess comes from a regression that does not yet have adequate structure, especially in desert regions. For V4.0 we have tightened constraints on the land surface retrieval; but for V5.0 we hope to have improved methodology. For now the user must accept that we have some known limitations in determining surface

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temperature, emissivity, and reflectivity over some land types. In particular, hot deserts are problematic.

There has been considerable confusion over the years about the use of "hinge points" to define the emissivity and reflectivity spectrum. Different retrievals may use different sets of hinge points. There is no physical meaning to the choice of hinge points. They are purely a method of describing a piecewise linear (in frequency) curve in spectral space. Whenever a user wants an emissivity at a particular frequency, the user should interpolate in frequency between the adjacent hinge points. Nothing philosophical should be read into the choice of hinge points or why they vary among profiles.

There have been some changes made to the water retrieval, especially the assumptions constraining the profile in the stratosphere where we have little sensitivity. For V4.0 there is a modest improvement in the water profile retrieval.

OLR Product Warning

The AIRS Team has discovered a software coding error which incorrectly calculates the Version 4 Outgoing Longwave Radiation Flux product (the field, "olr", in the Level 2 Standard Product, the Level 2 Support Product and the fields "OLR_A" and "OLR_D" in all Level 3 Products). These fields should not be used for atmospheric or climate research.

The Clear-sky Outgoing Longwave Radiation Flux product (the field, "clrolr" in the Level 2 Standard Product, the Level 2 Support Product and the fields "ClrOLR_A" and "ClrOLR_D" in all Level 3 Products) is not affected by this software coding error.

Data Products

All data are released to the public, regardless of the state of their validation.

In the V3.0 release, we recommended that users filter the data contained within the Level 2 Standard Product by consulting RetQAFlag and using only those fields-of-view (FOVs) for which this quality flag is zero. As a result, entire FOVs are excised from consideration.

In the V4.0 release, the definition of RetQAFlag has been modified to provide expanded information vis-à-vis the retrieval algorithm options that were exercised while processing an FOV. A set of quality flags has been provided to inform the user separately about the quality of the retrieval of various products at different altitude regimes. For a more detailed description of these quality flags, please read the Level 2 Quality Flags documentation

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V4.0_Level_2_Quality_Flags.pdf

Please refer to the following documents for additional quality assurance information.

Select_AIRS_QA_Fields.pdf

L1B_QA_Quick_Start.pdf

L2_QA_Quick_Start.pdf

Invalid Values

Fields in Level 1B and Level 2 data products may contain an invalid value:

- 9999 for floating-point and 16-bit and 32-bit integers
- 1 or 255 for 8-bit fields.

Collection 3 (no HSB) and Collection 4 (including HSB)

The HSB instrument ceased operation on February 5, 2003 due to a mirror scan motor failure. Release V4.0 of AIRS Data Products provide two collections up to the date of HSB failure, and a single collection thereafter.

- Collection 3 data products are those produced with no HSB data.
- Collection 4 data products are those produced with HSB data included.

Level 2 and Level 3 AIRS Data Product file naming convention has been modified with release V4.0 to allow users to easily determine whether the data include HSB or not. Here are two examples illustrating the naming convention:

AIRS Level 2 Standard Product produced without using HSB data (Collection 3)

AIRS.2002.09.06.183.L2.RetStd.v4.0.9.0.G04283152315.hdf

AIRS Level 2 Standard Product produced using HSB data (Collection 4)

AIRS.2002.09.06.183.L2.RetStd.v4.0.9.0.HSB.G04283152315.hdf

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Data Validation States

AIRS product validation states are “**Beta**”, “**Provisional**” and “**Validated**”. The state of product validation depends upon surface type, latitude and product type

Beta -- Early release product, minimally validated and may still contain significant errors. Available to allow users to gain familiarity with data formats and parameters but not appropriate as the basis for quantitative scientific publications.

Provisional -- Product quality may not be optimal and incremental product improvements are still occurring. General research community is encouraged to participate in the QA and validation of the product, but need to be aware that product validation and QA are ongoing. Users are urged to contact science team representatives prior to use of the data in publications. Provisional products may be replaced in the archive when the validated product becomes available.

Validated -- Formally validated product, although validation is still ongoing. Uncertainties are well defined, and products are ready for use in scientific publications, and by other agencies. There may be later improved versions of these products.

The validation states for Level 1B and Level 2 Data Products in V3.0 and V4.0 releases are:

AIRS Data Product Type	Version	3.0	4.0
Level 1B			
	AIRS Radiance	Prov	Val2
	VIS/NIR Radiance	Prov	Val2
	AMSU Radiance	Beta	Prov
	HSB Radiance	Beta	Prov
Level 2			
	Cloud-Clear IR Radiance	Beta	Val2
	Surface Temperature	Beta	Val1
	Temperature Profile	Prov	Val2
	Humidity Products	Beta	Val1
	Cloud Cover Products	N/A	Val1

Beta = Not suitable for scientific investigations.

Prov = Provisionally validated.

suitable for scientific investigations with caution.

Validated for nonpolar ($|\text{lat}| \leq 50^\circ$) night ocean only

Val1 = non-polar ($|\text{lat}| \leq 50^\circ$) day/night ocean.

Val2 = Val1 + non-polar ($|\text{lat}| \leq 50^\circ$) night land.

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The validation state for the new Level 3 Gridded Data Product matches that of the corresponding Level 1B or Level 2 Data Product from which it is generated.

Please refer to the accompanying Validation Report

V4.0_Validation_Report.pdf

This report provides the details of the validation of the AIRS/AMSU/HSB Level 1B and Level 2 Data Products using ECMWF and NCEP reanalysis, operational buoys, operational radiosondes and AIRS-dedicated radiosondes and other dedicated observations. Users of Level 3 Data Products should review the sections addressing validation of Level 2 Data Products.

Also see the paper:

Fetzer, E., L. McMillin, D. Tobin, M. Gunson, H. H. Aumann, W. W. McMillan, D. Hagan, M. Hofstadter, J. Yoe, D. Whiteman, R. Bennartz, J. Barnes, H. Vömel, V. Walden, M. Newchurch, P. Minnett, R. Atlas, F. Schmidlin, E. T. Olsen, M. D. Goldberg, Sisong Zhou, HanJung Ding and H. Revercomb, "AIRS/AMSU/HSB validation", *IEEE Trans. Geosci. Remote Sensing*, vol. 41, pp. 418-431, Feb. 2003.

AIRS/AMSU/HSB Instrument States and Liens

Atmospheric Infrared Sounder (AIRS)

The AIRS instrument entered 'operate' mode on 24 July 2002.

AIRS data are unavailable for the period 29 July 2002-14:14:13 to 30 August 2002-09:25:10 UTC because of instrument defrost activities and unexpected cooler shutdowns. (The shutdowns were apparently caused by ionizing radiation affecting the cooler electronics in the South Atlantic Anomaly.)

AIRS data are unavailable for the period 19 October 2002-17:03:5 to 22 October 2002-01:37:25 UTC due to a false overstroke trip by the AIRS cooler (likely caused by a radiation 'hit').

AIRS data are unavailable for the period 29 October 2003-02:00:00 to 14 November 2003-21:01:00 due to the instrument being placed in safe mode following a very large solar flare and associated coronal mass ejection. The purpose was to guard against possible permanent damage caused by the expected large flux of high energy particles (including protons). The instrument was completely off except for its survival heaters. Consequently, the AIRS instrument warmed. Upon restoration of power the instrument required

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prolonged cool-down and subsequent full recalibration of the spectral parameters.

AIRS IR Liens

- Per-granule measurements of spectral parameters (spectral_freq, spec_shift_upwell, etc.) and noise (NeN) are not stable enough for use as single granule measurements. Either use static values from channel properties files or smooth these measurement over longer time periods

AIRS Visible/NIR Liens

- In each scanline, at the left edge of the swath (first 3 IR footprints), the first few detectors of Channel 4 (the ones furthest South in ascending granules) have anomalously low values, less than 10% of their expected value. Since Channel 4 is primarily intended for use in a research product (energy balance studies) and the swath edges are of limited value, this problem is not considered critical.
- In the L2 Retrieved Support Product, the following fields related to cloud height have not been validated and should be ignored:

CldHgtMapVis, CldHgtCntVis, CldHgtCntVisErr

- There appear to be low-level signals in the VIS/NIR calibration and blackbody views, where none are expected. Neither is deemed serious at this time. Specifically:
 - The last sample of the blackbody in zero-based Channel 2. This occurs day and night, and is at the fraction of a DN level.
 - The last one or two samples of the photocalibrator assembly (when the lamps are off) in zero-based Channel 1. This appears to occur during parts of every daytime granule, and has not been seen at night. It is at the 1 to 10 DN level.
- A decrease in responsivity has been observed in Visible/NIR channel 0, and to a lesser extent in Channel 1. This has been compensated for by an empirical correction, but additional data are required to validate the correction.

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Advanced Microwave Sounding Unit (AMSU)

AMSU data are unavailable for the period 29 October 2003-02:00:00 to 6 November 2003-06:00:00 due to the instrument being placed in safe mode following a very large solar flare and associated coronal mass ejection. The purpose was to guard against possible permanent damage caused by the expected large flux of high energy particles (including protons). The instrument was completely off except for its survival heaters.

AMSU Liens

- On 11/16/2004 at 13:21:19 UT all of the AMSU-A2 temperature read outs except the warm load temperatures showed a sudden and simultaneous increase in noise. Subsequent analyses indicate that failure of a compensation capacitor in the reference voltage amplifier is the most probable cause. This will have a negligible effect on science products because RF shelf temperature enters into the calibration in a small second-order term. At the same time, however, the warm load temperature appeared to undergo a decrease of 0.15 K. Analysis continues to determine whether the warm load temperature offset continued. If so, the DN to EU conversion in the calibration algorithm will require modification.
- AMSU channel 7 exhibits abnormal noise levels
 - Noise level is about 5x NEdT on the average, but varies substantially
 - The added noise is not random; probable cause is spacecraft transmitter interference
 - The underlying random noise (NEdT) is within specs
 - Channel 7 should not be used until this systematic noise can be removed
- AMSU channel 6 exhibits some of the same noise characteristics as channel 7, however
 - Added noise level is a fraction of NEdT; overall level still meets specs
 - Use channel 6 with confidence
- AMSU channel 9 radiometer counts exhibit sudden, large change (~0.1%) recovering suddenly or gradually after 1-3 minutes; typically appears once or a few times per day, possibly clustered; no other channels affected
 - The phenomenon is being characterized; cause as yet unknown
 - Negligible effect in most cases; use channel 9 with confidence

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- AMSU-A exhibits scan asymmetry which produces scan-dependent negative bias in scene brightness temperatures
 - A left-right asymmetry is present; the right swath edge exhibits a greater negative bias than the left edge
 - Probable cause is asymmetric space/spacecraft radiative environment
 - Preliminary sidelobe correction coefficients have been computed from the antenna patterns measured on the ground and a simplified spacecraft model that takes into account mounting asymmetries
 - These corrections are currently being evaluated but have not yet been applied to the L1b products
- L1B data contain fields named “**antenna_temp**” and “**brightness_temp**”. Both are well calibrated and without sidelobe correction in this release. The **brightness_temp** data field will include sidelobe correction in a future release. In this release the two fields are identical.

Humidity Sounder for Brazil (HSB)

HSB has not been operational since 5 February 2003-21:50 UTC due to a failure in the scan motor electronics.

HSB Liens

- HSB exhibits scan asymmetry which produces scan-dependent negative bias in scene brightness temperatures
 - A left-right asymmetry is present; the right swath edge exhibits a greater negative bias than the left edge
 - Probable cause is asymmetric space/spacecraft radiative environment
 - No scene sidelobe corrections have yet been applied
- L1B data contain fields named “**antenna_temp**” and “**brightness_temp**”. Both are well calibrated and without sidelobe correction in this release. The **brightness_temp** data field will include sidelobe correction in a future release. In this release the two fields are identical.

Aqua Spacecraft Safing Events

The Aqua spacecraft underwent two safing events. The AIRS / AMSU / HSB instrument suite did not collect data during the following periods (all times are approximate to several minutes):

27 June 2002-15:40:30 to 28 June 2002-20:36 UTC

12 September 2002-13:15:00 to 23:24 UTC.

Occasional Data Outages

The AIRS / AMSU / HSB instrument suite has been shut down periodically for orbital correction maneuvers (drag makeup burns) and MODIS lunar calibration maneuvers. The two tables in the file below list all such outages up to Jan, 2005.

AIRS Ready/Operate Times due to MODIS lunar cal roll Maneuvers					
Year/DOY	Date	Guard Test Operate	Guard Test CheckOut	Ready (UT)	Operate (UT)
2002/200	Jul 19			19:55:22	22:30:30
2002/289	Oct 16			14:05:00	14:53:00
2002/319	Nov 15			4:29:00	4:58:00
2002/348	Dec 14			21:59:00	22:20:05
2003/013	Jan 13			18:37:00	19:03:00
2003/043	Feb 12	11:25:00	11:54:00	13:48:00	14:19:00
2003/073	Mar 14	6:00:00	6:29:00	7:26:00	7:59:00
2003/112	Apr 12	19:32:00	19:58:00	20:13:00	20:43:00
2003/132	May 12	4:54:05	5:20:00	5:47:00	6:14:00
2003/161	Jun 10	10:58:00	11:26:00	12:01:30	12:31:00
2003/190	Jul 9	12:07:00	12:33:00	18:09:00	18:44:00
2003/337	Dec 3	N/A	N/A	18:34:00	18:56:00
2004/002	Jan 2	10:22:00	10:50:00	15:10:00	15:33:00
2004/001	Feb 1	11:28:00	N/A	11:56:45	12:26:40
2004/062	Mar 2	6:41:00	N/A	7:10:00	7:45:00
2004/092	Apr 1	0:16:18	0:45:00	2:33:00	3:05:00
2004/121	Apr. 30	11:19:10	11:47:00	17:04:00	17:31:00
2004/150	May 29	23:10:00	23:37:00		
2004/151	May 30			4:18:00	4:46:00
2004/180	Jun 28	11:01:00	11:28:00	12:06:00	12:40:00
2004/297	Oct 23	20:25:35	20:51:00	22:12:00	22:47:00
2004/356	Dec 21	11:00:40	11:28:00	16:41:00	17:02:00
2005/020	Jan 21	7:55:00		8:25:00	8:56:00

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AQUA Drag MakeUp Burn Table since Launch				
Drag Burn No.	Year/DOY	Date	Drag burn Start Time	AIRS READY MODE DURATION
1	2002/192	Jul. 11	15:08:00	
2	2002/234	Aug. 22	15:32:00	
3	2002/259	Sep. 16	14:58:00	13:02 - 16:48
4	2002/290	Oct. 17	15:38:00	
5	2002/316	Nov. 12	15:40:30	14:20 - 17:26
6	2002/346	Dec. 12	15:40:00	14:30 - 17:26
7	2003/003	Jan. 03	15:55:00	15:00 - 17:38
8	2003/030	Jan. 30	21:26:00	19:22 - 23:00
9	2003/078	Mar. 19	16:15:00	15:25 - 18:03
10	2003/114	Apr. 24	16:29:42	15:59 - 18:38
11	2003/163	June. 12	15:47:30	14:55 - 17:30
12	2003/309	Nov. 5	15:00:00	13:14 - 16:45
13	2003/351	Dec. 17	17:10:00	17:06 - 19:31
14	2004/021	Jan. 21	16:00:00	15:00 - 17:46:33
15	2004/112	Apr. 21	15:49:00	14:44 - 17:30
16	2004/174	June. 22	20:46:00	19:05 - 22:31:48
17	2004/218	Aug. 5	10:31:46	9:44:00 - 12:13:48
18	2004/323	Nov. 18	15:32:02	14:30:00 - 17:17:00
19	2005/012	Jan. 12	18:32:51	17:46:00 - 20:26:50
20	2005/061	Mar. 3	17:47:00	16:58:00 – 19:28:50
21 aborted	2005/131	May 11	N/A	14:40:00 – 17:21:50
21	2005/133	May 13	16:20:00	15:50:00 – 18:01:50
22	2005/215	Aug. 3	16:40:00	15:52:00 – 18:31:50
23	2005/279	Oct 6	16:05:00	14:55:00 – 17:51:50
24 aborted	2005/335	Dec. 1	N/A	14:03:00 – 16:51:50
24	2005/342	Dec. 8	15:26:00	14:17:00 – 17:07:50

